

# **FRP Institute:**

## **2025 FRP Workshop**

### **FDOT District 4**

### **Fort Lauderdale, FL**

December 3, 2025



# FRP for Transportation Structures Engineers

## 7. FDOT District 6 FRP Project Case Studies (Steven Nolan P.E.)



**2025 FRP Workshop**  
**FDOT District 4**  
**Fort Lauderdale, FL, December 3, 2025**

# AGENDA – D6 Case Studies

- **US-1/Channel #5 Rehabilitation**
- **US-1/Cow Key Channel**
- **Bimini Drive/Sam's Canal (Duck Key)**



US-1/Cow Key Channel  
corrosion (2018)

09/15/2017



# D6 & Monroe Co.: FRP-RC/PC Projects

## Completed Project Summaries

1. City of Key West Bight Ferry Dock Extension ([412194-1](#) LAP Grant), *Fast-Facts*: CFRP-PC Piles.

2. Bakers Haulover Cut ([433378-1](#)), *Fast-Facts*: bulkhead cap and facing.

★ 3. **US-1 over Cow Key Channel** ([441740-1](#)), [E6L95](#), *Fast-Facts*: 6 spans (3 per bridge) replacement (*Luis Vargas/BPA*) – 10/31/19 letting ([BidTabs](#)) – complete (Nov 2020).

4. ...

5. ...

★ 6. **Bimini Drive at Duck Key – (Monroe County)**, letting 11/24/20, *Fast-Facts*, xCR-piles, GFRP-RC bulkhead cap - completed 2024.

# D6 (Monroe Co.): FRP-RC/PC Projects

## Active Project Summaries



1. **US-1/Channel 5 ([436523-1](#)) E6K61** - Precast/PT Pier rehab, Letting 8/27/2020. BSN. *status: Under construction, FRP-RC repair proposed (Revision 3).*
2. 117<sup>th</sup> St/Vaca Channel #2 ([448208-1](#)) ...
3. FKOHT over Bow Channel Old Bridge Rehab. ...
4. SR 907/Alton Rd ([430444-2](#)) Raising Road and adding pump stations ...
5. Snake Creek Bridge PD&E Study ([442670-2](#)...
6. Atlantic Isle Lagoon Historic Bridge Replacement ([430029-2](#))...



# Case Study 1: US-1/Channel #5



SR5 /Channel 5 ([436523-1](#)) E6K61 - Precast/PT Pier rehab, Letting 8/27/2020. BSN. **status:** *Under construction, FRP-RC repair proposed (Revision 3).*





# Case Study 1: US-1/Channel #5



SR5 /Channel 5 ([436523-1](#)) E6K61 - Precast/PT Pier rehab, Letting 8/27/2020. BSN. *status: Under construction, FRP-RC repair proposed (Revision 3).*



# D6: FRP-RC/PC Projects (continued)

## Completed Project Summaries

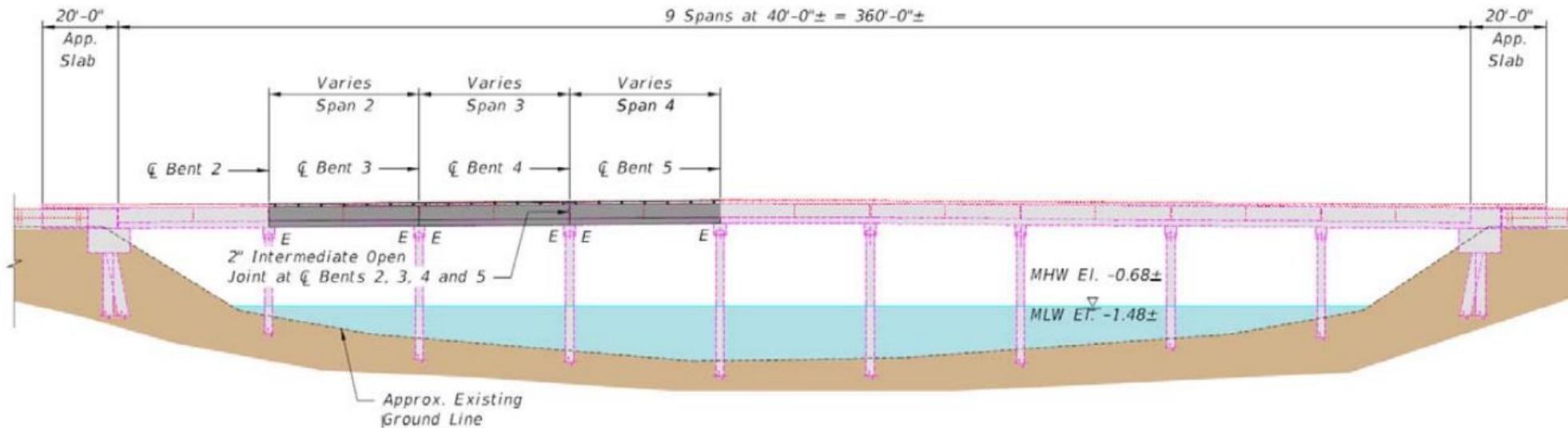
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- ★ 3. **US-1 over Cow Key Channel** ([441740-1](#)), **E6L95**, *Fast-Facts*: 6 spans (3 per bridge) replacement (*Luis Vargas/BPA*) – 10/31/19 letting ([BidTabs](#)) – complete (Nov 2020).
4. SR-112/I-195 Westshore waterway ([441967-1](#)) **E6M50**, *Fast-Facts* - bridge rehab: piles, bent cap & bulkhead cap repairs – 11/19/2020 letting [BSN](#) - complete 8/30/22.
5. SRA1A/Indian Creek Drive Drainage Mitigation ([439228-2](#)) **AS343**-City of Miami Beach. GFRP-RC Pump Station Pile Cap and Bulkhead Caps.

# ★ Case Study 2: US-1 over Cow Key Channel

US-1 over Cow Key Channel ([441740-1](#)), [E6L95](#), [Fast-Facts](#): 6 spans (3 per bridge) replacement (*Luis Vargas/BPA*) – 10/31/19 letting ([BidTabs](#)) – complete (Nov 2020).



# ★ Case Study 2: US-1 over Cow Key Channel



- US-1 over Cow Key Channel Bridges (NB-900086 & SB-900125) located in Florida Keys - Aggressive Environment
- Unique rehabilitation project: In a very complex setting
- Scope was to replace 3-40 ft spans in each bridge
- Maintain the same substructure
- Challenge: use of a shallow and light superstructure, simple to fabricate, light to transport and erect; extend service life
- Opportunity: use of a new FDOT system (FSB 12)- light structural member; GFRP rebar and CFRP strands – extend service life
- Construction time drove the cost of project

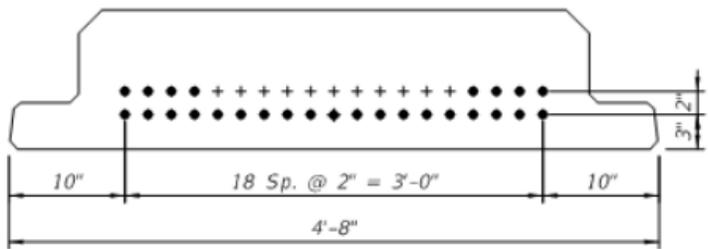
# ★ Case Study 2: US-1 over Cow Key Channel

- Construction Experience:
  - During procurement of materials, we had several interesting RFIs related to casting the FSB
  - Shop drawings-- Bending bar diagrams available (stirrups) had issues fitting the standard FDOT strand pattern – we re-arranged strand pattern timely
  - We had some issues with minor cracking on the anchorage zone, we rearranged stirrups to mitigate cracking at beam ends
  - We reduced the force at anchorages by debonding more strands
  - No issues with delivery of precast panels
  - Fortunate to have an excellent Precaster and Contractor

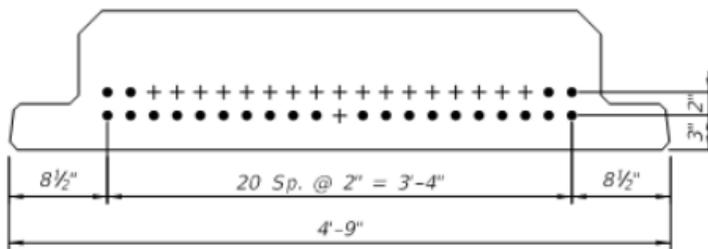
# ★ Case Study 2: US-1 over Cow Key Channel

## Florida Slab Beam Details: Strand Patterns

- Recommend using the same width units when ever possible (not like this?)



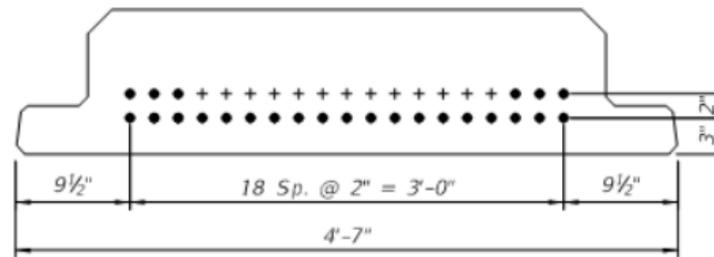
TYPE ① 27 STRANDS



TYPE ② 24 STRANDS

### FIBER-REINFORCED POLYMER REINFORCING:

1. FSB precast panels shall be reinforced using Glass-Fiber Reinforced Polymer (GFRP) and shall be prestressed using Carbon-Fiber Reinforced Polymer (CFRP).
2. All FRP reinforcing shall be per Specification Section 932 and 933.
3. FRP reinforcing detail dimensions are out-to-out of bars.
4. For standard bar bending detail for FRP, see FDOT Developmental Design Index D21310.



TYPE ① 25 STRANDS

← Now Index  
415-010

ITEM NUMBER	ITEM DESCRIPTION	UNIT	44174015201	44174015201	BR# 900086	44174015201	BR# 900125	QUANTITY TOTAL
0110- 3-	REMOVAL OF EXISTING STRUCTURES/BRIDGES 44174015201 900086	(LS)			1.000			1.000
0450- 8- 13	PRESTRESSED BEAM: FLORIDA SLAB BEAM, BEAM DEPTH 12", WIDTH 55-57"	LF			1046.000		1395.000	2441.000

# ★ Case Study 2: US-1 over Cow Key Channel

## Florida Slab Beam Placement

- Lifting Devices ?



# ★ Case Study 2: US-1 over Cow Key Channel

## FSB Concrete Topping (deck casting)

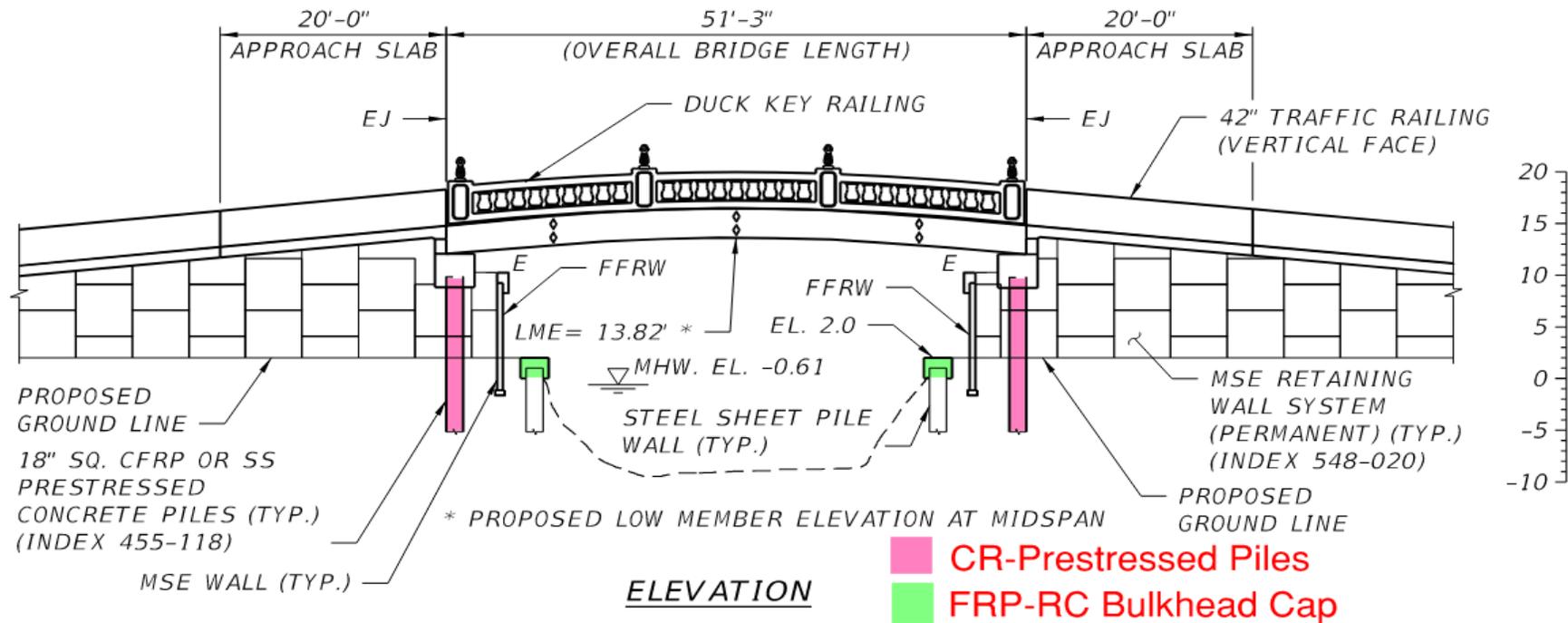


State Road 5 – Cow Key Channel Bridge Deck Pour



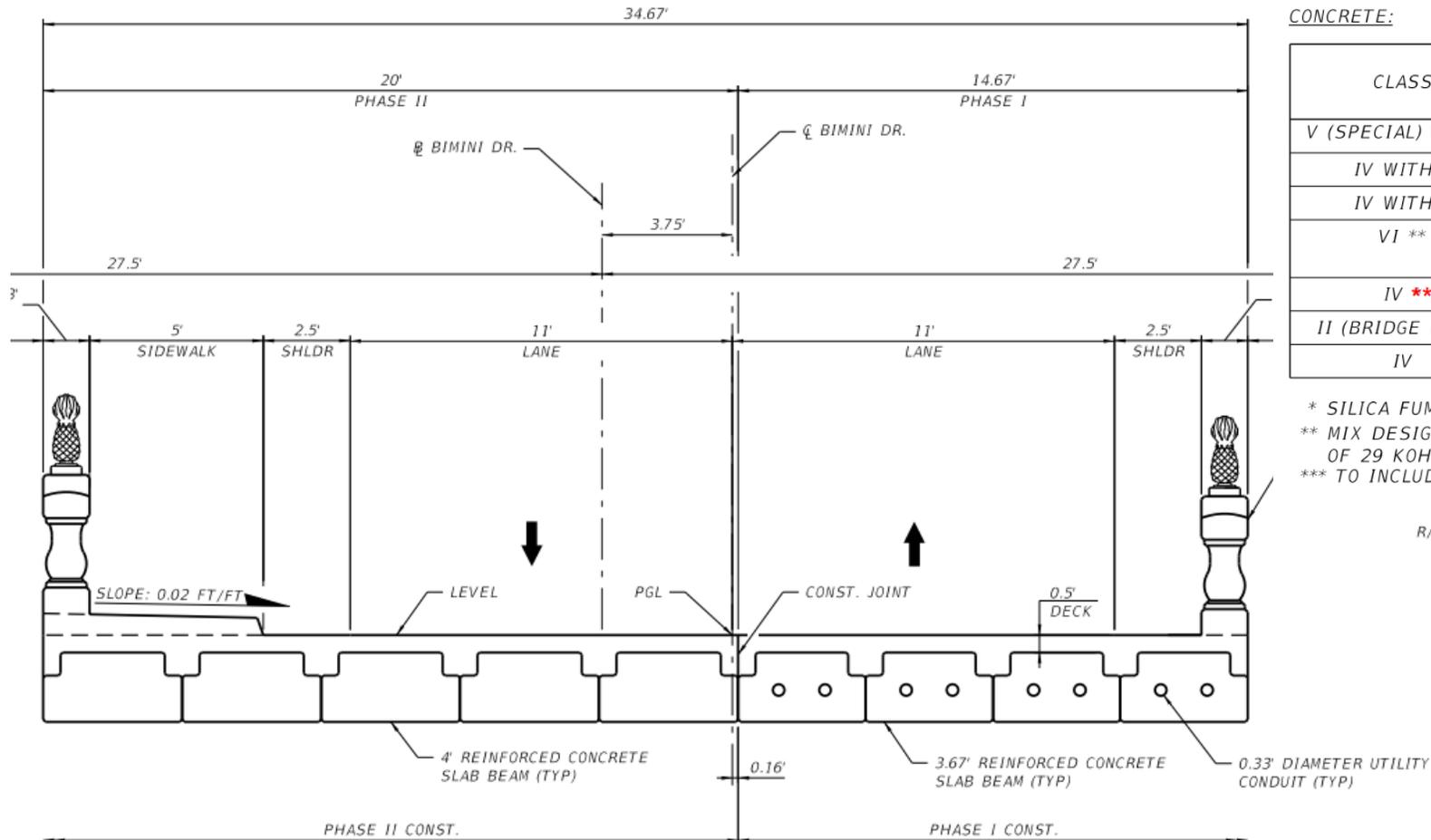
# ★ Case Study 3: Bimini Dr./Duck Key Channel

## Overview



# ★ Case Study 3: Bimini Dr./Duck Key Channel

## Typical Section (conventional reinforcing)



CONCRETE:

CLASS	MINIMUM 28-DAY COMPRESSIVE STRENGTH (PSI)	LOCATION IN STRUCTURE
V (SPECIAL) WITH *	6,000	18" CONCRETE PILES
IV WITH **	5,500	BULKHEAD CAP
IV WITH **	5,500	END BENT
VI **	8,500	REINFORCED CONCRETE BEAMS
IV **	5,500	C.I.P. DECK TOPPING ***
II (BRIDGE DECK)	4,500	APPROACH SLABS
IV	5,500	TRAFFIC RAILING BARRIER

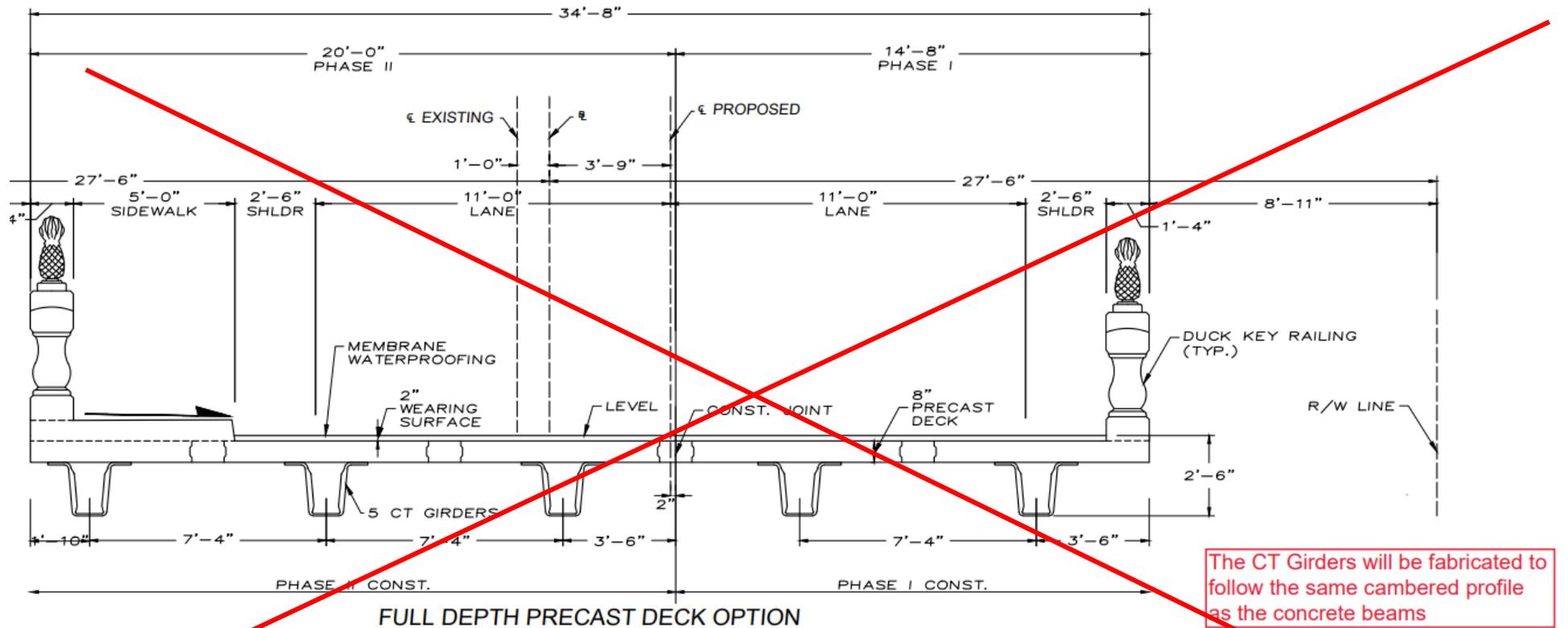
- \* SILICA FUME, METAKAOLIN OR ULTRAFINE FLY ASH. ← For HSS/SSR only
- \*\* MIX DESIGN SHALL MEET SURFACE RESISTIVITY VALUE OF 29 KOHM-CM
- \*\*\* TO INCLUDE SHRINKAGE REDUCING ADMIXTURE

R/W LINE

BRIDGE TYPICAL SECTION

# ★ Case Study 3: Bimini Dr./Duck Key Channel

## Proposed FRP Girder Alternate (rejected)



STATE	FL	FED. AID PROJ. NO.	TOTAL SHEETS	 55 BAKER BLVD, SUITE 205 BREWER, ME 04412 (207) 573-9055 WWW.AITBRIDGES.COM	CONCEPTUAL FOR REVIEW	BIMINI DRIVE DUCK KEY, FL  Plan & Elevation	BRIDGE SHEET NO.
JOB NUMBER			BR1				
CONTRACT NO.			SHEET				
BYAPP'D			1 OF 1 SHEETS				

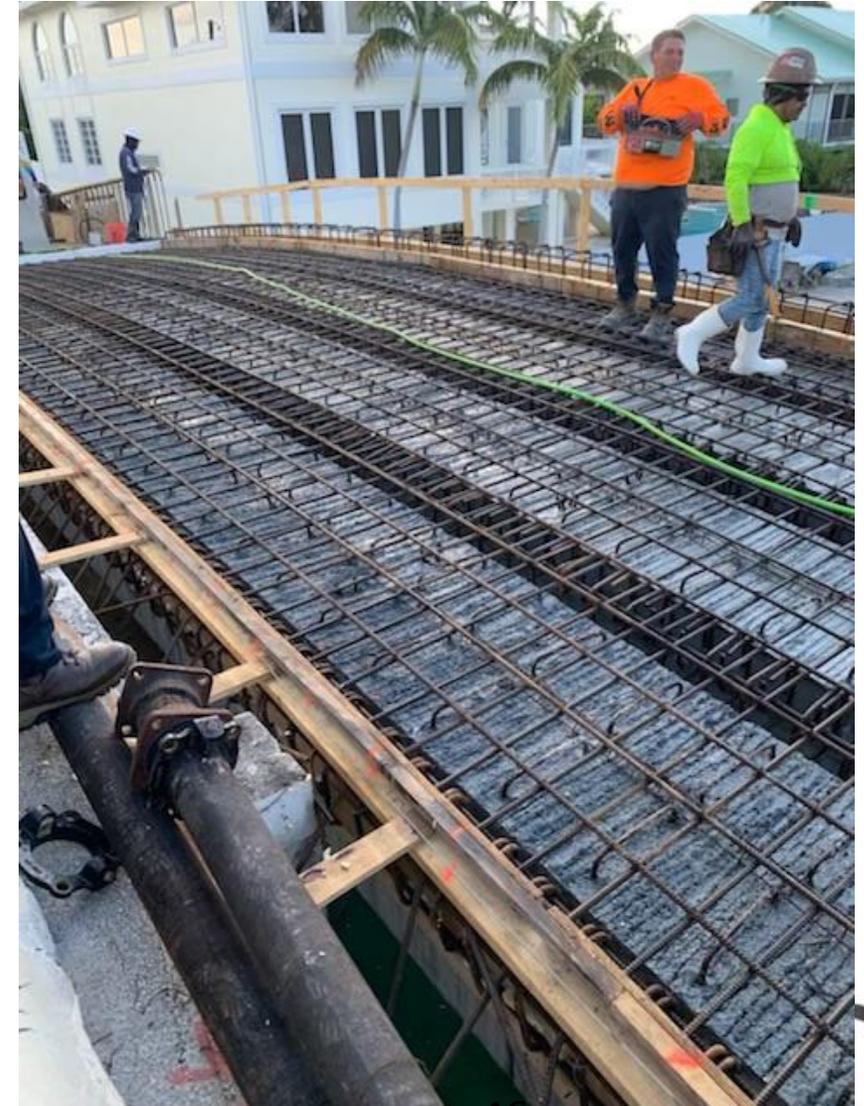
# ★ Case Study 3: Bimini Dr./Duck Key Channel

## Construction Photos: Girder Fabrication



# ★ Case Study 3: Bimini Dr./Duck Key Channel

## Construction Photos: Installation



# ★ Case Study 3: Bimini Dr./Duck Key Channel

## Bulkhead Cap (GFRP-RC)



# THANK YOU FOR ATTENDING

## Steven Nolan, P.E.

Assistant State Structures Design Engineer  
FDOT State Structures Design Office

[Steven.nolan@dot.state.fl.us](mailto:Steven.nolan@dot.state.fl.us)



## Member:

- ACI 440C, Code Committee – GFRP Reinforced Concrete for Building Specifications

# ★ CFRP-PC/BFRP-RC Double-Tees @ UM

## I-Bridge on UM

